

YIELD COEFFICIENT FOR SURFACE PENNING IONIZATION

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Helium atoms can exist in a long lived excited state with enough stored electronic energy to ionize any other atom or molecule except neon in slow collision. This process is an important source of charged particle production in discharges and plasmas, including many that are relevant to the laser, lighting and semiconductor industries. Often an important parameter is the probability of ionization when a metastable atom strikes a solid surface, generally called the yield coefficient, γ . Reported measurements of γ for gas covered surfaces (most surfaces are covered with a layer of absorbed gas molecules) vary by almost 50 %, an uncomfortably large uncertainty for accurate modeling. We have initiated both an experimental and computational study of this process. The experimental study consists of measuring the fraction of metastable atoms destroyed when passed through a fine wire mesh of various sizes and at different buffer gas pressures. The computational study involves a Monte Carlo Simulation of the random motion of a metastable/wire collisions for a given mesh geometry and buffer gas pressure. The connection between the experimental and computational results- and the only free parameter in the simulation – is the yield coefficient, γ .